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12   PATENT APPLICATION FOR A COMPUTER MOTIONAL COMMAND
13   INTERFACE
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16 Be it known that, Thomas G. Cehelnik, a citizen of the
17 United States having residence address at 35 Harbor
18 Village, Middletown, RI 02842, has invented a new and
19 useful method and apparatus, A COMPUTER MOTIONAL COMMAND
20 INTERFACE, for which the following is a specification.
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22
23 CROSS REFERENCE TO RELATED APPLICATIONS
24
25 This application is to receive benefit of 60/445,548 filed
26 2003 Feb 6, and 60/515844 filed 2003 Oct 30.
27
28 STATEMENT OF FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT
29
30 Not applicable
31
32 REFERENCE SEQUENCE LISTING OR COMPUTER PROGRAM
33
34 Sequence listing is not applicable. A computer program
35 using MATLAB language is provided to demonstrate a motional
36 command recognition algorithm.
37
38
39 BACKGROUND OF THE INVENTION—FIELD OF INVENTION
40
41
42   This invention relates to fields of computer
43 peripherals and motion recognition for the control of
44 electronic apparatus, specifically to aid in the input of
45 commands to computerized devices, and to add artificial
46 intelligence features to a user interface. It is related to
47 proximity and motion sensing of a person and objects.

48 BACKGROUND OF THE INVENTION
49
50
51 The ability to communicate with a computer through
52 peripherals has been developing for years from the punch
53 card, CRT, DOS keyboard line commands, windows type
54 programs using the mouse, light pens and stylists, to
55 speech recognition. All but speech recognition systems
56 require touch control. A speech recognition interface on
57 the other hand is not very useful in a public setting.
58
59 It has been determined by some researchers of human
60 communication that body language comprises as much as 80%
61 of the message communicated between people in a
62 conversation. Thus to improve communication between
63 computers by making the quality of human-computer interface
64 more humanly realistic and personal, a body language
65 interfaces is needed.
66
67 Thus human interaction with a computer is void of personal
68 realism for at least two reasons. One, the users does not
69 interact with the computer like they do a human being by
70 using body language and motional commands. Second, because
71 the computer fails to recognize and respond according to
72 the state of mind of the user normally indicated through
73 body language or motional commands. Thus to improve the
74 personal realism in communicating with a computer, a
75 motional command interface is needed with a sensing system
76 to recognize motional commands and body language.
77
78 Virtual reality systems detect and decipher motion by using
79 gloves with sensors or similar approaches with sensors on
80 the body for detecting motion. The drawback with these
81 methods is they require a physical connection to the user
82 making it awkward for many to use and to switch users.
83
84 Today wireless communication technology and GPS may offer
85 possibilities but they only track the location of the
86 device. Thus to recognize body language such as folding
87 arms, receivers and or transmitters need to be placed over
88 the user's body. Again such a system is complex connection
89 of transmitter and receivers located on the user's body.
90 Another drawback to these technologies is the method
91 requires the process of active radio transmission that at
92 times can interfere with communication in aircraft, medical
93 equipment. Active transmissions uses power and reduce
94 battery life on portable units. Active transmission is

95 also undesirable when trying to conceal the sensor system
96 from detection. There are at times when the RF exposure
97 may cause health risk or concerns to individuals. Also the
98 active transmission of RF is of concern to the regulating
99 authorities such as the FCC to avoid excessive electrical
100 noise. Hence, what is needed is a non-contact motional
101 command sensing system with option to operate passively.
102
103 Other motion sensing schemes include real time video image
104 analysis, sonar, radar, laser or infrared. Video analysis
105 tends to lack depth perception, and only senses in two-D
106 unless a variable focal length lens is used. The others
107 sensing methods becomes impractical to implement a motional
108 command language interface due to hardware cost, complexity
109 of hookup, and required processing power. Although the
110 later may provide 3-D imaging, the main difficulty with
111 these technologies is beam forming is required. Hence what
112 is needed is a simplified method of implementing a motional
113 command interface on personal computing and electronic
114 devices.
115
116 At times the motion sensor may require concealment by
117 embedding it in a material while still maintaining passive
118 features. It is true that the video analysis is a passive
119 process, and infrared may be; but neither of said can
120 covered by common materials such as construction material
121 and still sense the motional command.
122
123 Computers widely used today mostly issue a command or
124 response in the form of keyboard strokes, mouse movements
125 and clicks, with the exception of speech recognition.
126 Computer access speed is compromised for simple and
127 intuitive tasks when using a mouse, keyboard or stylist to
128 click and point. Examples are in reviewing video or
129 information on forms and screens, one my need to push the
130 stop, forward, or okay button with a mouse.
131
132 Additionally, repetitive movements of using mechanical
133 peripherals often cause injury, such as running of a scroll
134 button, or clicking to close a window. These motions all
135 rely on some mechanical movement of a peripheral device or
136 involve a pointing process with a pen or finger on a touch
137 sensitive screen. Lets referrer to this method as the
138 screen method.
139
140 In the screen method the interaction zone between the user
141 and computers is the two-dimensional plane of the screen.

3

142 This method of interfacing human commands to the computers
143 is tedious and particularly so on small video screens as on
144 palm-sized devices. Hence, the human interface with the
145 computer is slow and tedious. What is needed is a faster
146 touchless method of controlling the computer through
147 motional command language where the commands are detected
148 in a volume of three-dimensional space called the
149 interaction zone as opposed to mouse movements mapped to a
150 physical two-dimensional flat space on a computer screen.
151
152 Systems using mechanical peripheral pointing devices and
153 the screen method also require visual interaction to
154 operate. This is at time tedious for even simple tasks.
155 Also this method is inconvenient for use with mobile
156 computing device or while being mobile such as when driving
157 a car. They are also inconvenient when the user is too
158 distance a from the computer unit to see a mouse cursor.
159 They are also not applicable when the user is walking into
160 a room and wishes to use hand signals to issue a commands
161 to turn on and adjust the lighting. Another example is
162 when the user is lounging in a chair in front of the TV and
163 the remote control is elsewhere. In this case if a motional
164 command systems were installed to have the interaction zone
165 at the location of the person in the chair, the user could
166 issue a motion of the hand to change the TV channel or fast
167 rewind a DVD. Thus what is needed is a motional command
168 language system self-contained in a computer video display
169 unit, and with options to have a remote-sensing units
170 distributed throughout the home or convenient locations.
171
172 In summary our sensing system requirements are, to make
173 computer-human more natural, peripheral control devices
174 need to be self-contained or embedded into the computer or
175 in objects where the computer is to be controlled from, be
176 touchless, non-contact, offers passive wireless technology
177 capability, operate in a three dimensional interactive
178 zone, remove tedium of visual screen inspection, and senses
179 and respond to motional commands of the user, and
180 ultimately body language.
181
182 No known prior art addresses all the above sensing system
183 requirements for a motional command system.
184
185 In this invention uses sensors to detect electric fields by
186 measuring the electrical potential in space. An electric
187 potential measurement is done with a high input impedance
188 electrode so the circuit attached to it does not alter the

189 potential under measurement. The frequency is so low the
190 fields are almost static or quasistatic, and therefore obey
191 the principles of electrostatics. These type of fields are
192 called E-fields.
193
194 The prior art by Neil Gershenfeld and Joshua R. Smith in
195 U.S. Patent 6,051,981 uses electric field sources created
196 by a transmitter with a different sensing method. They also
197 disclosed a gesture wall, and a Phish as a mouse
198 controller. Their sensing method measures currents from a
199 transmitter and into receiving sensors. Their sensors
200 electrodes are effectively at earth ground electric
201 potential. This fact causes the receive sensors to distort
202 the electric potential distribution in space simply by
203 their presence. Plus there is not a passive option,
204 since the currents need measured from the transmitter.
205 Other prior art referenced in their patent seem to not to
206 have the capability or recognize value of operating
207 passively.
208
209 Beaty discloses in on the Internet in 2000, a discrete FET
210 circuit and an operational amplifier circuit to detect
211 electric fields signals from static electric charge. The
212 amplifier produces a signal with strength indicative of
213 proximity to static charge only. The disclosed is directed
214 toward detecting static charged objects. No motional
215 command system is mentioned. Also nothing is said about
216 detecting uncharged objects.
217
218 Other capacitive type proximity sensors using AC frequency
219 shift due to changes in oscillator capacitance have been
220 recognizes around the time of the advent of radio circuits.
221 These methods suffer from low input impedance, and
222 consequently lack range, and alter the background field by
223 the antenna. This occurs because a resonant tank circuit is
224 used. They also require an oscillator attached to an
225 antenna, so it is really an active method.
226
227
228
229 The inventor is not aware of prior art found passively
230 using the AC 50 Hz-60 Hz part of the electromagnetic
231 spectrum with a high input impedance device. In fact, most
232 low frequency electronic devices designers struggle to
233 filter out the energy in this frequency band.
234
235

236 BACKGROUND OF INVENTION-OBJECTS AND ADVANTAGES
237
238
239 The lower the frequency of the electric fields, the more a
240 quasistatic the electric fields become such that:
241
242   a) objects except conductors appear as high impedance
243   electrical loads thus do not distort the electric
244   field much, i.e, are essential transparent;
245
246   b) even slightly conductive objects having contact with
247   earth ground have a substantially lower impedance
248   than nonconductors in contact with ground;
249
250   c) electrostatic principles apply;
251
252   d) the electric fields penetrate deeply through objects.
253
254
255 Gershenfeld et. al.disclosures state 100 kHz as an
256 operating frequency. Also demonstrated devices, as
257 recalled, operated at frequencies of around 0.5 MHz. At
258 these frequencies, the objects in vicinity of the body
259 being detected are more so conductive than at frequencies
260 below 1 kHz. Thus distortion may occur and contribute to
261 nonlinearities.
262
263 Gershenfeld does state his method requires the solution of
264 nonlinear equations. Also the solutions are degenerate,
265 i.e., not unique defined. Also, his method of using
266 electrodes at ground potential also requires measurement of
267 current from a transmitter. Their measurement of current
268 from the transmitter is to determine the total amount of
269 current that could be detected in the sensors. If objects
270 of low electrical potential are near, they will distort the
271 potential field and affect the measurement accuracy by
272 reducing current arriving at the receive electrodes.
273
274 The present invention uses receivers with high input
275 impedance so as not to draw currents or distort the field.
276 Also, in the passive mode, the frequencies of operation are
277 that of or near the electrical power line frequency and are
278 surely quasistatic. These frequencies are extremely low,
279 and substantially reduce the conductivity of objects near
280 to the sensor. Thus preventing field distortions.
281

6

282 With further amplification circuitry not show, we found in
283 the passive case, the sensitivity of the 60 Hz A.C.
284 amplitude was found to depend linearly after taking the
285 logarithm of the response. The sensitivity was detected to
286 a range of about 40 inches. This range is sufficient to
287 have good motional command zone defined in front of a
288 computer monitor, or other device and appliances.
289
290 It is one aspect of this invention to make computers and
291 robots more human-like by increasing the personal realism
292 of interacting with these devices through a motional
293 command system (MCS) that offers a friendly and efficient
294 means of interfacing the user's motional commands and body
295 language with the computer.
296
297 It is another aspect of the invention to provide a personal
298 computer interface that responds more efficiently with less
299 tedium than using pointing device peripherals.
300
301 It is another aspect of the invention to allow the user of
302 the MCS to interact more naturally, and be more mobile and
303 active will interacting with a computer.
304
305 It is another aspect of this invention to make a touchless
306 motional command system (MCS).
307
308 It is another aspect of the invention to provide a method
309 for processing MCS data so the computer can recognize and
310 respond to motional commands and body language of the user
311 with or without additional modalities.
312
313 Another aspect of the invention is to make as sensing
314 system for the said MCS.
315
316 It is another aspect of this invention to provide the
317 computer with visual display or other device having a video
318 display unit have a self-contained motional command system
319 (MCS) that includes sensor system, electronic hardware, and
320 software.
321
322 It is another aspect of the invention to provide a MCS with
323 remotely locatable sensing system as a peripheral for
324 receiving motional commands.
325
326 It is another aspect of the invention to provide a method
327 for defining commands for recognition, and dispatching of
328 computer responses as a result of the recognition, so the

329 computer is trained to recognizes and responds to the
330 motional commands of the user.
331
332 Another aspect of the invention is to provide a passive
333 method to detect motional commands issued to the computer.
334
335 Another aspect of the invention is to provide a passive
336 method to detect a body's presence and motion.
337
338 Yet another aspect of the invention is provide a method for
339 processing MCS body language commands whereby the computer
340 can recognize moods and emotions or matters of urgency of
341 the user and thus responds with helpful processes and gives
342 a personality to a computer.
343
344
345
346

346   BRIEF DESCRIPTION OF DRAWINGS
347
348   The invention will be better understood upon reading the
349   following Detailed Description while referencing the
350   provided drawings.
351
352   FIG1 shows a schematic for the Motional Command Sensor
353   amplifier.
354
355   FIG2 shows the Thevenin equivalent circuit for the antenna
356   with effect of adding capacitance C_{opt} that occurs when the
357   user's motional-command surface is near antenna. This
358   model shows the source voltage into the amplifier is
359   reduced as the motional command surface approaches the
360   antenna, hence the sensitivity of the amplifier is
361   decreased. Model predicts from observed measurements that
362    $C_{opt} = 1/9\ C_{ant}$. The high input impedance of the TL082 makes
363   the voltage input sensitive to changes in source impedance.
364   This amounts to sensitivity to small changes in capacitance
365   at low frequencies such as the A.C. line frequency of 60
366   Hz.
367
368   FIG3- Shows preferred embodiment of Motion Command System
369   on a video monitor. Six MCS sensors either are used in
370   single ended mode relative combined in a differential
371   amplifier to measure difference with respect to reference
372   sensor 7. Alternatively, sensors 1 through 6 have a
373   reference electrode along with the main antenna, so that
374   two buffer stages like those in FIG1 are combined with a
375   differential amplifier, and then driven with the filter and
376   amplifier.

377 DETAILED DESCRIPTION- PREFERRED EMBODIMENT
378
379
380 To those skilled in of electronics will recognize the
381 variation of the technology.
382
383 The local background noise characteristic of the A.C. line
384 and computer signals are detected and modulated by the
385 presence of the user's command surface in the vicinity of
386 the motional command system (MCS) sensors.   Here the
387 command surface is referred to as the hand or body part
388 issuing the motional command.
389
390 FIG1 describes the sensor as consisting of a small 4 in.
391 long antenna with an amplifier assembled on a solderless
392 breadboard.   The input stage is a buffer amplifier with
393 high input impedance, followed by a low pass filter and
394 then an amplification stage.
395
396 At the low frequency of 50-60 Hz of the A.C. line, the
397 antenna acts as an equivalent electric source in series
398 with a capacitor represented in FIG1 as C_{ant}. To understand
399 this   model,   we   recall   that   the   conductor   is   an
400 equipotential surface maintained at a potential determined
401 from the background electric fields. Now consider the case
402 when the user's body is held at a constant electric
403 potential such as the case when the user is grounded or
404 held an electric potential by a voltage source. By moving
405 the user's hand or command control surface, toward the
406 antenna, charge on the antenna rearranges itself.   This
407 polarization of charge on the antenna and surrounding
408 objects is necessary to assure the electric potential is
409 maintained on each object.
410
411 The above effect is very well known and is published for
412 the case of an electrostatic source.   It is commonly
413 recognized when a static electricity source is moved in the
414 vicinity of a high input impedance amplifier. The problem
415 is a static electricity source is needed. Thus this
416 phenomenon is not the preferred sensing method in the
417 embodiment of this invention.
418
419 Instead, what is invented is a motional command system that
420 uses the electric polarization phenomenon as a means to
421 modulate the sensor's sensitivity to a characteristic
422 background source. The physics of the process used in this
423 disclosure is one involving scattering field theory rather

424 than source field theory like that for the electrostatic
425 source. The motional commands are also discernable from DC
426 offsets produced by electrostatic sources source such as
427 lightning, or static buildup on the user or surroundings.
428 The method of detection and signal processing method is now
429 described for building a computerized motional command and
430 body language interface.
431
432 A new feature in this invention is the deliberate use of
433 the background noise characteristics to detection motional
434 commands and body language. In this case, the motional
435 commands modulate the sensitivity of the sensor to the
436 characteristic A.C. background. In this case, the induced
437 polarization charge on the antenna is caused by a spatial
438 change in the electrical potential conditions. The
439 electrical potential in the spatial dimension satisfies
440 Laplace's equation. Doing so dictates the presence of the
441 polarization charge on the antenna and the surrounding
442 objects.
443
444 FIG2 shows a model of the amplitude reduction using a
445 voltage divider. The capacitance C_{opt} occurs between the
446 person's hand or body in proximity to the sensor, and the
447 sensor. Since the antenna is small compared to wavelength,
448 the antenna is not resonant, and the source impedance of
449 the antenna is that of a capacitor. The capacitance
450 depends upon the antenna geometry and its position relative
451 to the surrounding objects. In the absence of the presence
452 of the MCS user, i.e. beyond the range of the sensor, the
453 capacitance C_{ant} is a small value probably having a stray
454 capacitance of about 5-30 pF. Thus the antenna is a high
455 impedance source at 50-60 Hz of order 10^9 Ohms. The parallel
456 input resistor of 2.5 Megaohm reduces the antenna input
457 impedance to this value causes some filtering and allows
458 bias currents to flow. However, the amplifier is still
459 very sensitive to the voltage across its input because the
460 TL082 has an input of 10^{12} Ohms.
461
462 When the MCS user is held at an electrical potential such
463 as ground, and the user's command surface such as his or
464 her hand is placed within the interaction zone of the MCS,
465 additional polarization occurs to the charge on the
466 antenna. This is equivalent to an additional capacitance
467 forming between the antenna and ground. This capacitance
468 is represented in FIG1 as C_{opt}. It is noted that the user is
469 typically held at ground potential to see the effect of the
470 C_{opt} best; but it is at times convenient to modulate the

471 user's electrical potential between ground potential and
472 another so as to encode the modulation of the
473 characteristic background. Hence command signals and body
474 language from multiple users of the MCS could be coded and
475 decoded so at to avoid interference. There are several
476 methods or means to doing this. One is to naturally rely
477 the electrically conductive property of the shoes. Another
478 is to have the person touch a ground electrode or a
479 modulated grounded electrode while giving the motional
480 command.
481
482 The effect of the presence of C_{opt} is to reduce the
483 sensitivity of the amplifier. Such reduction results in a
484 noticeable amplitude modulation of the characteristic
485 background noise waveform produced at the output of the MCS
486 sensor in FIG1.
487
488 The capacitance C_{opt} is expected to behave as some inverse
489 power to distance of separation between the antenna and the
490 user's command surface. Also, it is expected to be
491 proportional to the area of the antenna in the direction of
492 the vector connecting the antenna center and user's command
493 surface. It is also proportional to the command surface
494 area.
495
496 For the circuit shown in FIG1, built on a prototyping
497 board, a sensitivity of about 18 inches from the antenna
498 was observable on an analog oscilloscope. The location was
499 at the breakfast table of a newly constructed home. The
500 setup uses a TL082 Texas Instrument JFET OP amp. The
501 amplitude decreases as the user's hand approached the
502 antenna that is a 4 inch piece of number 22 solid copper
503 wire with insulation. This is in agreement with the model
504 and the fact that capacitance appears inversely
505 proportional to distance over this range of distances. The
506 change in voltage is about 10% of 250 mV peak-to-peak
507 signal. If the user is grounded through the ground wire in
508 the electrical wiring the observed output signal from the
509 cicuit in FIG1 increased to 2.5 V peak to peak. Again the
510 change in amplitude as the hand approached the sensor
511 antenna is about 10%. Also, the signal is optionally
512 frequency modulated by placing a resistor about 10 kOhm and
513 a switch between the user and the common of the amplifier.
514 Such a method may be used to make unique identification of
515 issues of motional commands.
516

517   The sensitivity of the circuit to user motion is in part
518   due to the high voltage sensitivity occurring from high
519   input impedance of the buffer amplifier, and in part due to
520   the filtering. The high frequency noise is removed by the
521   low pass filter appearing before the gain stage shown in
522   FIG1. The input circuitry to the buffer stage acts as a
523   high pass filter. In fact, the output of signal level of
524   the buffer stage is about 5 mV peak to peak for the
525   particular level of 60 Hz AC background. Additionally, the
526   final gain stage in this embodiment has a gain of about 50.
527
528   The resistor parallel to the amplifier input is used to
529   cause some high pass filtering and to prevent the
530   amplification stage from saturating by adjusting input
531   level to the gain stage and by providing a return path for
532   the amplification stage.
533
534   A variable resistor voltage-divider is also alternatively
535   used as a to adjust the sensitivity by limiting the input
536   into the low pass filter prior to the final amplification
537   stage. The overall sensitivity to both the characteristic
538   background and the modulation due to motional commands is
539   also achieved by placing a capacitance in parallel with the
540   shunt resistor R1 in FIG1.
541
542   Since the modulation is only 10% of the characteristic
543   signal amplitude, a differential amplifier is easily placed
544   between to MCS sensors of FIG1. Preferably to antennas
545   would drive two buffer stages like that in FIG1; but
546   immediately afterwards a differential amplifier such as the
547   Burr Brown LM105 would be used. The output of the
548   amplifier would then go to the low pass filter and the
549   final amplifier stage like that in FIG1.
550
551   The particular values of components used, and the measured
552   voltages depend upon depend upon the features of the
553   characteristic signal used as input to detect the
554   modulation due to capacitance changes between the antenna
555   and the user. It is clear to anyone working in the art
556   that the exact output level and sensitivity of the motion
557   command system sensor shown in FIG 1, depends upon the
558   users environment. Such variables are the ambient
559   characteristic noise level input to the buffer amplifier
560   and the frequency thereof, the antenna and input impedance
561   characteristics of the amplifier, and the electrical
562   potential, electrical conductive properties, and the size
563   of the user control surface. Those skilled in the art of

564 electronics are able to modify and or make adjustable
565 circuit parameters and physical properties of the system to
566 have a MCS sensor to be tunable to operate in the users
567 environment. But none-the-less the principle of operation
568 is the sensitivity of the amplifier to the characteristic
569 background noise is modified by the presence of the users
570 command surface within the interaction zone of the sensor.
571
572 The motional commands system is sensitive to motional
573 commands having duration of 0.5 – 3 second. The preferred
574 embodiment of the MCS is in a computer or video display
575 unit. FIG3 indicates the placing of sensors on the sides
576 edges of a CRT computer monitor makes an array of MCS
577 sensors. The sensors may be placed inside the monitor
578 housing. Sensor sensors are placed to the left and right,
579 top and bottom, and front and back of CRT monitor display
580 area. The antennas of the sensors are oriented vertical
581 direction on the right and left sides, horizontal on the
582 top and bottom, and horizontal to the screen on the front
583 and back. To make the positions of the sensor clear, FIG 2
584 shows the layout.
585
586 The sensors work in pairs. The sensors on the right and
587 left side are used to sense motion along the horizontal
588 axis while the sensors on the top and bottom are used to
589 sense motion along the vertical axis. The sensor pair on
590 the front and back are used to sense motion along the axial
591 axis perpendicular to the face of the screen.
592
593 Each sensor in the array sends a voltage signals to a data
594 collection system that can process the signals. Such a
595 system can be a stand-alone computer processor such as a
596 DSP and analog to digital (A/D) converter, and support
597 electronic hardware, or it can be the computer device the
598 user is interfacing to with the MCS supplemented by some
599 support electronic hardware. We refer here to the support
600 electronic hardware including the A/D, control circuitry,
601 and supplemental signal conditioning as the MCS support-
602 ware.
603
604 In the preferred embodiment, the sensor signals are run
605 into a differential amplifier so as to subtract out the
606 background noise level. This may be done in hardware or
607 software. The signals are digitally recorded by the
608 computer soundcard. The sound card sampled at an
609 appropriate rate to preserve quality. Prior to entering
610 the soundcard, some hardware is used to multiplex the

611 analog signals from the six MCS sensors and amplify the
612 signals if necessary. Thus the data from each sensor is
613 sampled at 8 kHz if 48 kHz sampling rate is used on the
614 sound card. Other sampling rates are off course possible.
615 Additional amplification is also used to make the maximum
616 input to the line of about 2.0 V peak to peak.   An
617 automatic gain control circuit is easily implemented. This
618 amplifier comes after the MUX in the signal stream.
619 Additionally, there are voltage comparators placed on the
620 output of each sensor. Other triggering schemes are easily
621 envisioned, such as by nearly real time software I/O.
622
623 The interaction zone is defined as the volume of space
624 where the motional commands are processed. The focal point
625 is defined where as the origin in space where the motional
626 commands will be issued.   In the preferred embodiment,
627 this is in front of the computer monitor a distance of
628 about the separation between the horizontal pair of MCS
629 sensors.   At this point the user places their command
630 control surface such as their hand. The MCS is activated
631 and calibration data is collected by the data acquisition
632 system. The data is used to scale the signals so the
633 difference between signals from the pair of sensors is zero
634 at the focal point.
635
636 Next the user defines motional commands. By activating the
637 command recorder software program, the sensor data is
638 collected while the user issues the desired command to be
639 recorded. This process is done several times to establish
640 statistics and a database of commands. The signals from
641 the sensor are used as training data for the MCS processing
642 software. Commands to be issued by the computer as also
643 assigned during the training period. Triggering threshold
644 levels and logic are also determined during this process.
645
646 Next an MCS command is issued.   The sensors begin
647 collecting data for a set duration of 0.2-3 seconds when
648 the analog trigger level is exceeded. This happens upon
649 motion of the user control surface about the interaction
650 zone focal point. Based upon the signal processing of the
651 training data, the trigger levels are determined and set
652 automatically in the MCS support-ware by MCS software. Next
653 the computer processor runs a digital processing algorithm
654 and decides whether a command that was programmed is
655 recognized. If so, the system responds with appropriately
656 programmed action.
657

658 The digital processing command recognition algorithm
659 extracts the envelope of the signals from the MCS sensors.
660 Applies a calibration base on the focal point calibration.
661 Then normalizes the data to maximum value of unity. From
662 this cross correlations are computed between each channel
663 of the training data and the channel data of the recorded
664 acquisition. From the results correlation coefficients are
665 obtained between the recorded command channel data and the
666 training data. Commands are recognized by correlation
667 values exceeding threshold values set on the correlation
668 coefficients. The thresholds are set on six correlation
669 coefficients for each channel, the autocorrelation, and
670 five cross correlation coefficients.
671
672 The preferred embodiment is the most advanced application,
673 and the number of sensors can change and be as few as one.
674 For A.C. operation as describe the person or body is
675 preferably grounded or connected to a switched grounded
676 connection. For D.C. signals are recognized well when the
677 person or body is not grounded. They appear well an
678 increase in potential followed by a negative tail when the
679 A.C. signal is filtered to remove the A.C. component of the
680 line frequency. There are also intermediate states of
681 conductivity between the body and the ground that result in
682 a mixture both A.C. and D.C. components in the signal. The
683 extent depends upon the filtering chosen and the gain of
684 the subsequent stages of amplification, not shown of FIG1.
685 Also, transient fields from charge polarization where
686 potentials from muscle flexing can generate charge
687 polarization that are possibly detected as the hand extends
688 quickly to and fro the sensor.
689
690 Also the invention covers variations in implementation
691 including hardware and software. The sensors can be
692 implemented to detect DC offset caused by ungrounded
693 bodies. The DC is seen more readily when the signal is low
694 passed filtered and amplified. An ungrounded individual
695 moving their hand passed the sensor is detected by
696 recognizing the DC offset. This may only be a transient
697 response, but being useful it is also covered in this
698 invention for certain application of controlling devices
699 such as toys. Otherwise the DC component shows up as a DC
700 offset occur on the AC signal. Depending upon the degree of
701 further amplification, it may be difficult to remove when
702 caused by a transient sources such as passing the hand
703 passed the sensor. Thus at times the DC component is
704 indicative of proximity and useful in devices.

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706 The invention may be used to detect a body's presence or
707 the motion, such as an individual by either the D.C. shift,
708 or A.C. amplitude reduction, and in some cases both
709 phenomena.

710

711 The application of the invention applies to the sensing
712 method, and is useful to make toys that producing music,
713 lights, and motion of some object, triggered or controlled
714 by the signal detected by the said sensors. In particular,
715 a baby mobile, or a toy similar to the popular "Musini" by
716 NeuroSmith, a toy that plays music as the children jump.
717 Both these devices, and others, can benefit from the E-
718 field sensor technology described in this invention. Also
719 doors could be opened closed easily by hand motion. Also,
720 the a person can also be detected by sensing through a door
721 to notify as a door bell, or warn if someone is coming
722 through the door.

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